



Milk replacer feeding rates and whole or flaked corn in starters

When feeding more than 1.65 lb milk replacer solids daily to calves, this will likely limit calf starter intake.

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Al Kertz, PhD, DIPL ACAN

ANDHIL LLC, St. Louis, MO

andhil@swbell.net

www.andhil.com

Milk/milk replacer feeding rates began increasing from a low traditional feeding rate (Kertz et al., 1979) to the point that in the 2014 NAHMS report it was found to be 6 quarts daily vs only 4 quarts in the 2007 NAHMS report. That is a 50% increase! The origin of an early weaning program was in the 1920s with various Cornell studies (Kertz et al., 2017). So, perhaps it was fitting that feeding an accelerated program also began at Cornell with a study by Tikofsky et al (2002). An objective of an early weaning program was to develop the rumen by more intake of the calf starter. This minimized milk replacer feeding usually to only a month, and maybe 25 lb dry basis. This interrelationship between milk replacer feeding level and starter intake is the key issue in calf performance before, during, and after full weaning.

In a meta-analysis by Gelsinger et al (2016), within the range of those data and the studies summarized, there is about a 2:1 ratio decline for each additional amount of milk or milk replacer solids fed and starter consumed. Implicit in this relationship between milk or milk replacer intake and starter intake is that the latter is key to rumen development and weaning of the calf. If there is

inadequate starter intake and for a long enough time, and there is not a well texturized starter fed or some roughage with an all pelleted starter, rumen development will not be adequate for a good weaning program; and performance after weaning. Two studies (Hill et al., 2016a,b) were reviewed (Kertz 2016) in showing the negative impact of feeding high milk replacer levels on post-weaning performance. It was speculated that this was due to inadequate rumen development and function. Then in 2018 (Shivley et al.) found in a NAHMS survey that Holstein calves averaged 1.6 lb daily gain before weaning and only 1.2 lb after weaning. In an attempt to further explore this situation, van Niekerk et al., (2020) did a study with at the Provimi Nurture Research Center with collaboration from researchers then at the University of Alberta.

Forty-eight Male Holsten calves at 3 to days of age were used in this study. These calves came from one dairy farm, were fed 2 liters of fresh colostrum within an hour of birth, fed 2 L of whole pasteurized milk daily until transported to the Center for trial. Two trial phases consisted of a pre-weaned (up to 6 weeks when weaned) and pos-weaned (weeks 7 to 8) for phase one individually housed and fed, followed by reallocation within preweaned treatments into groups of 4 calves per pen for 9 to 16 weeks. Milk replacer (MR) fed contained 26% CP/20% as-fed fat and mixed at 14% solids, along with the same 18% CP as-fed texturized starter with either whole or steam-flaked corn at 37% with the balance of the starter consisted of 25% whole oats, 3% molasses, and 35% protein/mineral pellet. Four treatments in a 2x2 factorial were: 1.65 lb (**LO**) or 3.3 lb (**HI**) milk replacer fed daily with either whole (**WC**) or flaked (**FC**) corn in starter. Milk replacers were fed twice daily for 5 weeks, and then at a half level for the 6th week until full weaning with a step-up and step-down feeding program for the high milk replacer feeding program over the 6-week period. During weeks 9 to 16, calves were fed a mixture of 95% starter with 5% chopped grass hay. Fecal samples were collected for digestibility measurements over a 5-day period at weeks 5 and 8, followed by pen fecal collection during weeks 11 to 12. Ruminal fluid samples were collected 4 hours after morning feeding during weeks 5 and 8 for fibrolytic bacteria identification and enumeration. Only select data and conclusion will be included in this column.

Table 1. Calf performance and other data. **LO-WC** is low level milk replacer (**MR**) feeding with whole corn in calf starter (**CS**), **LO-FC** is with flaked corn in starter, **HI-WC** is high level milk replacer feeding with whole corn in calf starter, **Hi-FC** is with flaked corn in starter.

	LO-WC	LO-FC	HI-WC	HI-FC	SEM

Initial weight, lb	89.0	87.4	89.6	89.4	2.33
Preweaned-6 weeks					
MR DMI, lb	62.3	61.7	90.9	93.7	1.75
CS DMI, lb	17.4	15.9	6.6	9.7	1.75
Daily gain, lb	1.12	0.95	1.37	1.55	
Postweaned 7-8 weeks					
DMI, lb	55.3	48.2	44.1	42.1	3.12
Daily gain, lb	1.69	1.52	1.27	0.90	
Grouped 9-16 weeks					
DMI, lb/day	13.7	12.6	12.8	12.8	
Daily gain, lb	4.83	4.80	4.11	4.14	

Key conclusions:

- Feeding more milk replacer increased daily gain with reduced calf starter intake preweaned, but reduced both postweaned compared to lower level milk replacer feeding.
- While dry matter intake was not decreased in the 9-16--week grower phase for calves fed more milk replacer preweaned, it did decrease daily gains compared to those calves that had been fed less milk replacer preweaned.
- Digestibilities of dry matter, NDF and ADF were reduced post weaned for calves fed higher level of milk replacer preweaned.

- Rumen samples showed no differences at weeks 5 and 8 in density of total and the fibrolytic bacteria community. But at 5 weeks, *B. fibrosolvens* density tended to be greater in calves fed low level of milk replacer. And % proportion of total bacteria of *Clostridium* cluster IV and *B. fibrosolvens* tended to be 2-fold greater in calves fed the lower level of milk replacer feeding.
- Whole or flaked corn did not really make any differences in various parameters measured. This is consistent with other data such as Leismeister and Heinrichs (2004) previously reviewed (Kertz 2005). However, there is a caveat here. If the corn is quite hard and flinty, this can reduce digestibility if not processed more. In a study in China (Du et al., 2021), we found that cracked corn in a texturized starter had lower digestibilities than when ground and in a pelleted starter. This was also quite visible in feces, and verified by both indigestible NDF and acid insoluble ash methods.
- These effects of milk replacer feeding levels are exemplified and amplified further in a meta-analysis (Hu et al, 2020) published in the same issue of the *Journal of Dairy Science* as the study addressed in this column (van Niekerk et al, 2020).

The Bottom Line

When feeding more than 1.65 lb milk replacer solids daily to calves, this will likely limit calf starter intake. In turn, this can limit rumen development, and subsequent to weaning limit digestibility and daily gain—even with a texturized starter. This information can aid in developing milk replacer feeding and weaning programs, along with insuring that starter intake occurs at a level and length of time prior to weaning to minimize post-weaning slumps.

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